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(54) Abstract Title
Pipe-mounted cyclone dust collecting device for a vacuum cleaner

(57) A cyclone dust collecting device for a vacuum cleaner includes a cyclone body 20 and a cyclone housing 30 for separating contaminants from the air drawn into the cleaner. The cyclone housing 30 includes a cyclone cover 31 and a dust collecting container 35. The cyclone cover 31 is cylindrical and has one end coupled to the cyclone body 20. The other end is a slanted end wall 31a with an aperture 31b and a centrally located dome-shaped protrusion 31c. The dust collecting container has a correspondingly slanted open end, which is detachably engaged with the slanted end of the cyclone cover. The other end of the dust collecting container 35 is tapered. The slanted end wall 31a of the cyclone cover 31 protects a grille 22 in the cyclone dust collecting device during operation and removal of contaminants from the dust collecting container 35.

FIG.2

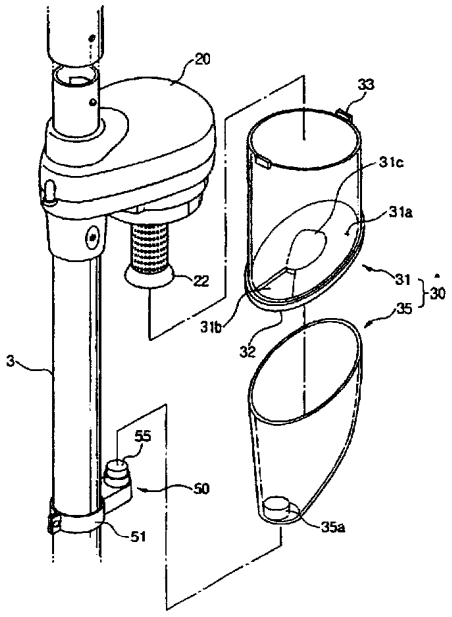

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FIG. 1

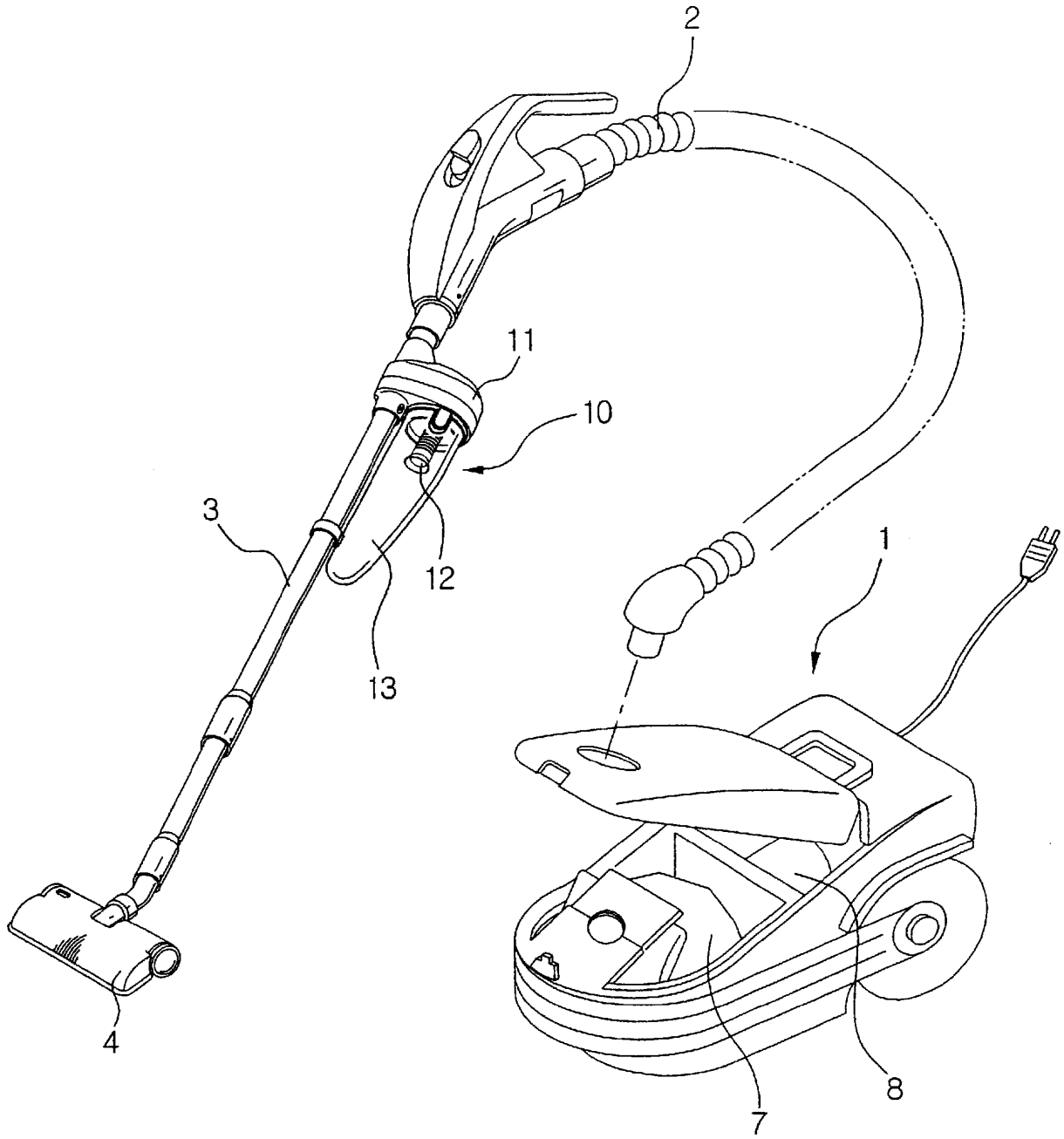


FIG.2

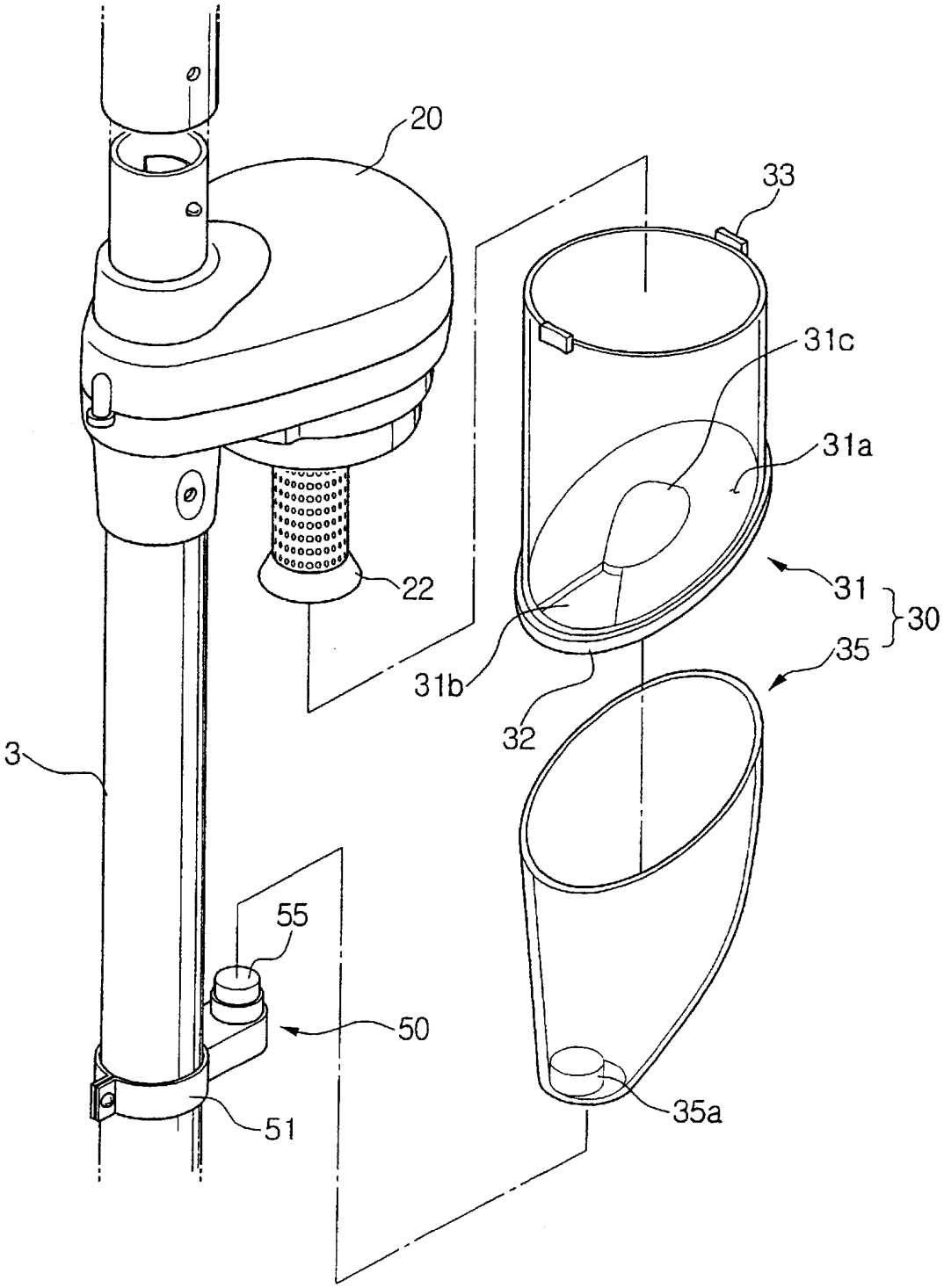


FIG.3

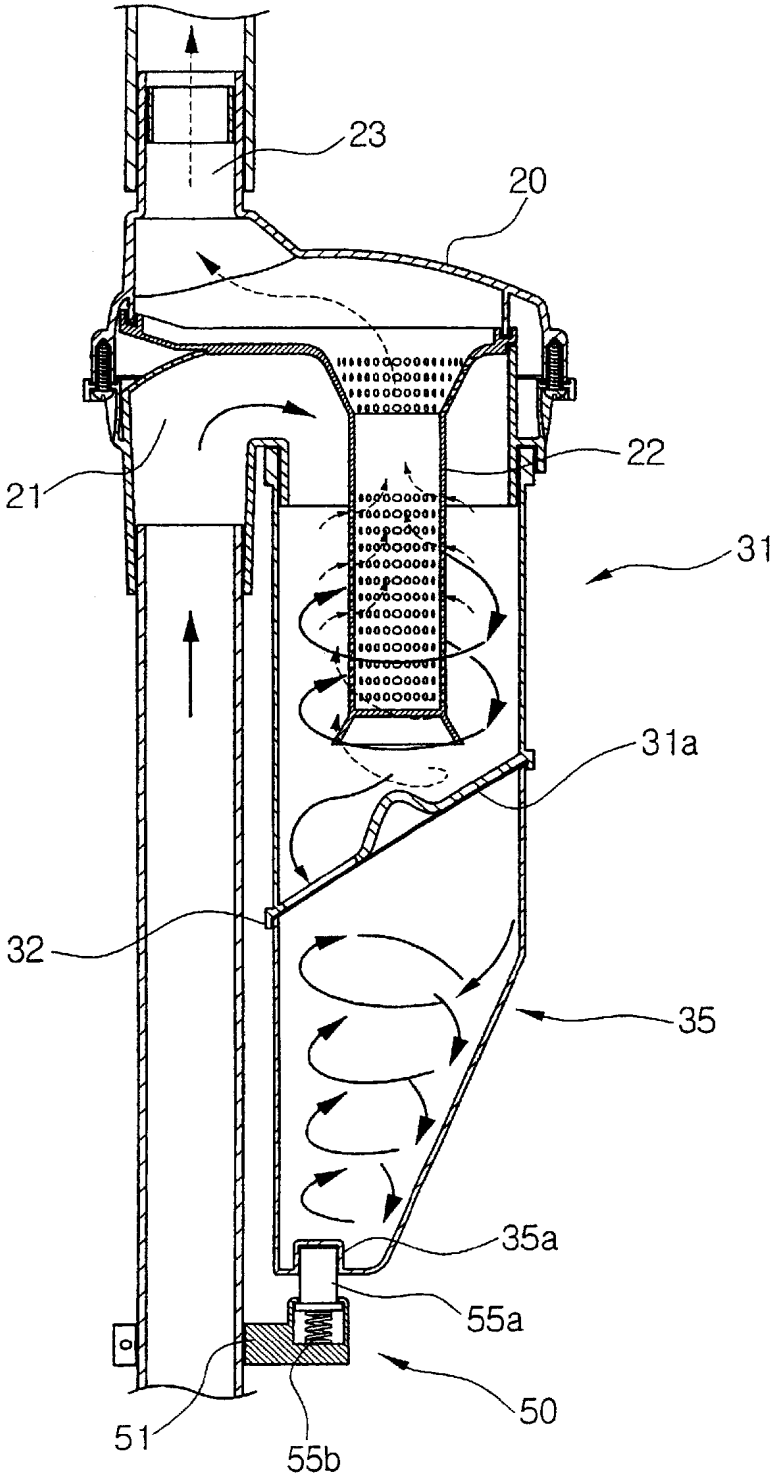


FIG.4

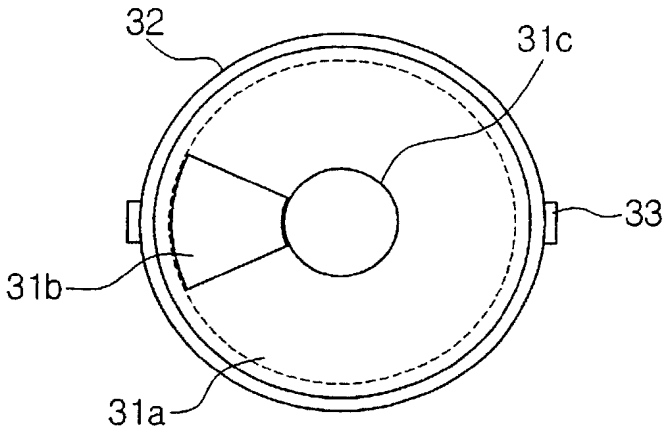
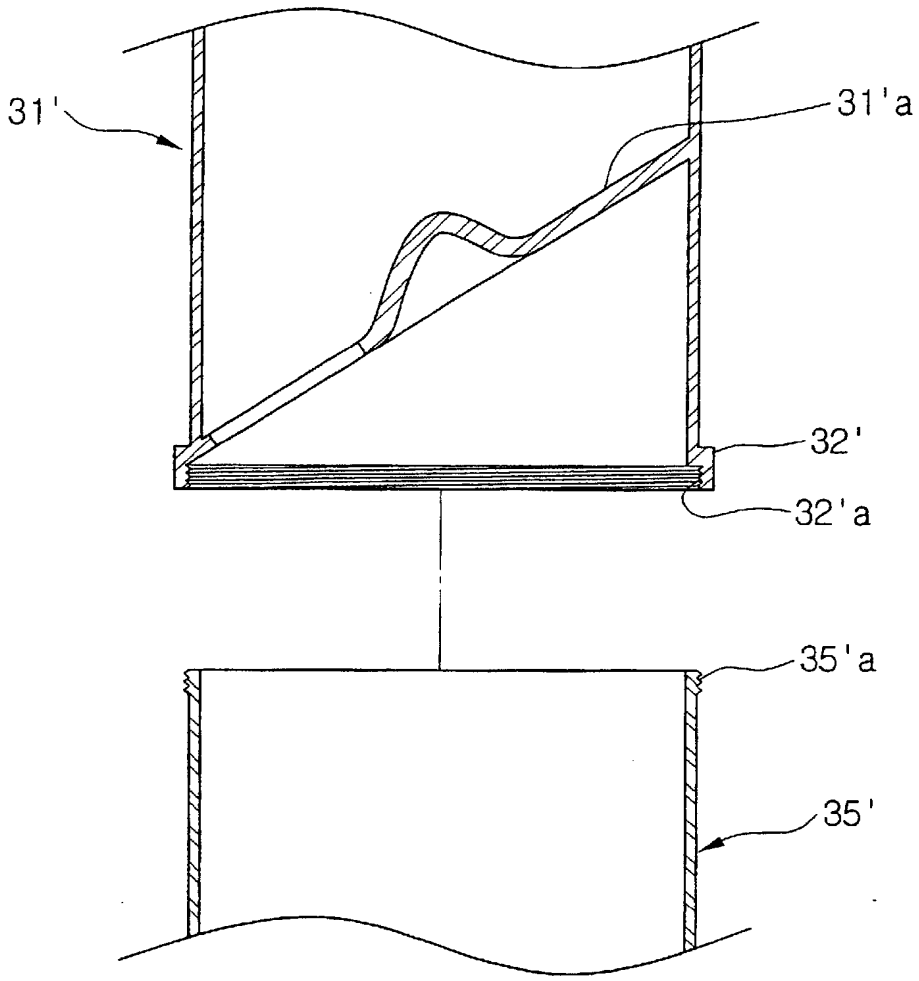


FIG.5



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CYCLONE DUST COLLECTING DEVICE FOR A VACUUM CLEANER

The present invention relates to a vacuum cleaner, and more particularly to a cyclone dust collecting device for mounting on a telescopic extension pipe of a vacuum cleaner.

Cyclone dust collecting devices for separating particles from a fluid using centrifugal force are well known. Due to their simple structure and ability to withstand high-temperature and high-pressure environments, they have been widely used in industrial fields for a long time. It is known to employ such a device in a vacuum cleaner, to first filter and then collect contaminants including relatively large particles such as pieces of tissue, vinyl, hairs, and the like, from the air that is drawn in through a cleaner brush. The cyclone device may be used to prevent these larger contaminants from reaching a downstream paper filter disposed inside a dust collecting chamber of the cleaner, thereby extending the life of the disposable paper filter.

Referring to Figure 1 which is a perspective view of a vacuum cleaner equipped with a conventional cyclone dust collecting device, the cleaner has a cleaner body 1, a brush or suction head 4 for drawing in contaminants, a flexible hose 2 and a telescopic extension pipe 3 for connecting the brush 4 to the cleaner body 1, a paper filter 7 for filtering out the contaminants, and a fan motor 8 for generating a suction force. A cyclone dust collecting device 10 is mounted on a connecting portion between the telescopic extension pipe 3 and the flexible hose 2 to filter out larger particle contaminants.

The cyclone device 10 is arranged such that air and contaminants drawn in through the brush 4 due to the suction force generated by the fan motor 8, enters a cyclone housing 13 of the cyclone device 10 obliquely. Various kinds of relatively large contaminant particles, such as pieces of tissue, vinyl, hairs, and the like are separated from the air by the centrifugal force which is caused by a vortex of air in the housing 13, where these larger particles are then collected. When the clean air reaches the bottom of the housing 13, it reverses direction and turns into a rising air flow that is expelled to the cleaner body 1 through the flexible hose 2.

During operation of the cleaner, the orientation of the cyclone device 10 may change either intentionally or unintentionally. That is, the cyclone device 10 can be tilted or turned upside-down when cleaning higher locations, causing the contaminants collected in the cyclone housing 13 of the cyclone device 10, such as tissue, vinyl, hairs, and the like, to fall toward a grille 12 of the cyclone device 10. When such a reverse flow of contaminant occurs, the contaminants can block the grille 12 decreasing the cleaning efficiency of the vacuum cleaner or disabling its operation. Therefore, blockage of the grille due to a reverse flow of contaminants should be prevented.

According to a first aspect of this invention, a cyclone dust collecting device for a vacuum cleaner includes a cyclone body for connection to a telescopic extension pipe of the cleaner and arranged to generate a swirling vortex from an inflow of air and contaminants that have been drawn in and a cyclone housing detachably engaged with the cyclone body. The cyclone housing has a slanted partition with a through-hole formed therein. The slanted partition divides an interior of the cyclone housing into an upper space for separating the contaminants from the air by guiding the vortex of air, and a lower space for receiving the contaminants that have been separated from the air. The cyclone housing preferably includes a cyclone cover having a cylindrical shape, an open upper end engaged with the cyclone body, and a lower closed end that is closed by the slanted partition. The preferred cyclone housing further includes a dust collecting container having an open end detachably engaged with a lower portion of the cyclone cover. The open end of the dust collecting container is slanted to correspond with to the slanted partition of the cyclone cover.

The dust collecting container may include a closed end which is slanted to correspond to the slanted partition.

The slanted partition of the cyclone cover may include a dome-shaped protrusion formed on a centre thereof.

In the preferred cyclone dust collecting device, supporting means are provided to support the cyclone housing with respect to the telescopic extension pipe and prevent separation of the cyclone housing from the cyclone body.

The supporting means may include a fixture member fixed to the telescopic extension pipe, an insertion member movably disposed on the fixture member and inserted in a recess formed on a lower end of the cyclone housing, and an elastic member for biasing the insertion member into engagement with the recess.

The preferred cyclone housing includes a cyclone cover having a cylindrical shape, an open upper end engaged with the cyclone body, and a lower slanted end which is slanted at a predetermined angle with respect to the slanted partition. The cyclone housing may further include a dust collecting container having an open end engaged with the lower portion of the cyclone cover by a screw connection. The dust collecting container receives contaminants that have passed through the through-hole of the slanted partition.

Advantages of the above-described device are that normal cleaning can be performed regardless of the orientation of the vacuum cleaner or dust collecting device. Damage to the grille when the dust collecting container is removed is prevented since the grille is shrouded by the cyclone cover rather than being exposed. The presence of a dividing wall between the grille and the chamber formed by the dust-collecting container reduces the chance of contaminants blocking the grille and of unwanted dispersal of contaminants because they have fallen from the grille, and dispersal of collected contaminants from the grill when discarding the contaminants.

According to a second aspect of the invention, a vacuum cleaner comprises a cleaner body, a telescopic extension pipe coupled to the cleaner body via a flexible hose,
and a cyclone dust collecting device mounted to the telescopic extension pipe wherein, the cyclone dust collecting device includes: a cyclone body mounted on the telescopic extension pipe, the cyclone body generating a swirling vortex from an inflow of air and contaminants; and a cyclone housing detachably engaged with the cyclone body, the

cyclone housing having a slanted partition with a through-hole formed therein, the slanted partition dividing an interior of the cyclone housing into an upper space for separating the contaminants from the air by guiding the swirling vortex of air and a lower space for receiving the contaminants that have been separated from the air

The present invention will now be described by way of example with reference to the drawings, in which:

Figure 1 is a perspective view of a vacuum cleaner having a conventional cyclone dust collecting device;

Figure 2 is an exploded perspective view of a cyclone dust collecting device in accordance with the invention, the device being shown mounted to the wand of a vacuum cleaner;

Figure 3 is a cross-sectional view of the cyclone dust collecting device of Figure 2;

Figure 4 is an underside view of a cyclone cover for the cyclone dust collecting device of Figure 2; and

Figure 5 is a fragmentary cross-section of an alternative cyclone cover and a dust collecting container, with a screw-threaded connection between the two.

Referring to Figures 2 and 3, a cyclone dust collecting device has a cyclone body 20 and a cyclone housing 30. The cyclone housing 30 includes a cyclone cover 31 and a dust collecting container 35. A support part 50 is provided on the telescopic extension pipe 3 of the vacuum cleaner to support the dust collecting container 35 such that the dust collecting container 30 does not become detached from the cyclone cover 31 during a cleaning process.

The cyclone body 20 is connected to the telescopic extension pipe 3 of the vacuum cleaner and includes an inlet air passage 21 for obliquely guiding air and contaminants

which are drawn in through the brush 4 (Figure 1), a grille 22 for filtering the air inside the cyclone cover 31, and an outlet air passage 23 for guiding the air that is drawn in through the grille 22 to a cleaner body 1.

The cyclone cover 31 is cylindrical and hollow and is connected to a lower portion of the cyclone body 20. The cylindrical wall of the cyclone cover 31 induces the air that is drawn in from the inflow air passage 21 of the cyclone body 20 into a vortex. One end of the cyclone cover 31 is open and has a plurality of engagement protrusions 33 formed therein for connection with the cyclone body 20. At the other end the cyclone cover has a slanted end wall 31a.

The slanted end wall 31a includes an aperture 31b formed therein for guiding the contaminants into the dust collecting container 35. The aperture 31b may be formed by cutting away a portion of the slanted end 31a of the cyclone cover 31 in a circumferential direction of the cyclone cover 31 to a predetermined length. Here, the length of the aperture 31b can vary according to the size of the cyclone dust collecting device. The slanted end 31a is on an incline that guides the contaminants, which have been separated from the vortex of swirling air, to the dust collecting container 35, along with a certain portion of the swirling air. Preferably, the slanted end 31a is inclined at an angle ranging from 15° to 30° with respect to a vertical cross section of the cylindrical cyclone cover 31.

Furthermore, an engagement part 32 having a stepped shape is formed around the slanted end 31a. The engagement part 32 secures the cyclone cover 31 to the dust collecting container 35.

In this embodiment, the slanted end wall 31a has a projection 31c directed, inwardly into the cover interior. This projection is in the form of a dome-shaped protrusion extending from the centre of the end wall 31a for efficiently guiding the contaminants to the dust collecting container 35. The diameter of the dome-shaped protrusion 31c can vary depending on circumstances, but preferably ranges from approximately one-fourth to one-third of the diameter of the cyclone cover 31.

The dust collecting container 35 which is substantially cylindrical and has a closed end and an open end engages the engagement part 32 of the cyclone cover 31. The open end of the dust collecting container 35 is slanted to correspond with the slanted end wall 31a of the cyclone cover 31, so that the cyclone cover 31 and the dust collecting container 35 are flush and form a straight line in cross-section when engaged with each other. For location and support of the container 35, a recess 35a is formed in the lower portion of the container closed end to receive a support part 50 associated with the cleaner wand 3.

Preferably, to reduce the swirling vortex of air from the cyclone cover 31 and also to help the user to mount the dust collecting container 35 onto the telescopic extension pipe 3, the closed end of the dust collecting container 35 is tapered slightly to have a smaller area than that of the open end, the latter corresponding to the slanted end of the cyclone cover 31.

The recess 35a formed on the lower portion of the closed end of the dust collecting container 35 has a shape and a size which correspond to an insertion part 55 of the support part 50. The recess 35a receives the insertion part 55 of the support part 50 to secure the dust collecting container 35 to the telescopic extension pipe 3.

The support part 50 further includes a fixture member 51 that is mounted to the wand or telescopic extension pipe 3. A circular clamp of a size corresponding to the outer diameter of the telescopic extension pipe 3 is provided at one end of the fixture member 51 to engage the pipe 3. The insertion part 55 is mounted to the other end of the fixture member 51.

The insertion part 55 includes a pin 55a, which is inserted in the recess 35a of the dust collecting container 35, and a compression coil spring 55b for biasing the pin 55a outwardly, i.e. towards the cyclone body 20. The pin 55a and the compression coil spring 55b have appropriate lengths to allow smooth separation of the dust collecting container 35 from the engagement part 32 of the cyclone cover 31 when the user holds

and presses down the container 35, and to prevent separation of the container 35 from the cyclone cover 31 during a normal cleaning process.

Another technique for connecting the dust collecting container 35 to the cyclone cover 31 is shown in Figure 5. Referring to Figure 5, an engagement part 32' of a cyclone cover 31' is not formed along the periphery of the slanted end wall, but formed along the inner periphery of the lower end of the cyclone cover 31'. The engagement part 32' of the cyclone cover 31' is formed with a female screw thread 32'a, and the outer periphery of the open end of the dust collecting container 35' is formed with a male screw thread 32'b for engagement with the female screw thread 32'a. Accordingly, the container 35' is connected to the cyclone cover 31' by screwing it into the engagement part 32' of the cyclone cover 31'. In this case, the support part 50 can be omitted due to the interlocking engagement of cover 31' and container 35'.

Operation of the cyclone dust -collecting device will now be described.

Air and contaminants are drawn into the vacuum cleaner through the brush 4 and flow into the cyclone dust collecting device through the inlet air passage 21 of the cyclone body 2, as shown in Figure 3. As the air and contaminants enter the cyclone cover 31, they form a swirling vortex of air and contaminants. Larger particle contaminants contained in the air are separated from the air by the centrifugal force of the swirling vortex and then drop on the bottom of the cyclone cover 31. Most of the air that is free of contaminants hits the slanted end 31a of the cyclone cover 31 and reverses direction, forming a rising air stream. The rising air stream is expelled to the cleaner body 1 through the grille 22 and the outlet air passage 23.

When the contaminants have been separated from the air by the centrifugal force, the air falls and is discharged in a swirling air flow through the aperture 31b formed in the slanted end wall 31a of the cyclone cover 31. Since the contaminants are blocked by the lower end wall 31a , the contaminants in the dust collecting container 35 are not discharged through the cyclone cover 31, but rotate in the swirling air flow within the container 35.

The cyclone cover 31, in co-operation with the cyclone body 20, induces the incoming air into a swirling vortex and separates contaminants from the air using centrifugal force. The aperture 31b formed in the slanted wall end 31a guides the contaminants into the dust collecting container 35. The dust collecting container 35 serves as a receptacle where the separated contaminants are collected. That is, since a separation part for separating contaminants from the air is separated from a dust collecting part for collecting the contaminants separated from the sucked air, the contaminants separated by the centrifugal force do not flow in a reverse direction toward the grille 22 of the cyclone body 20 and, therefore, cannot block the grille.

To empty contaminants from the dust collecting container 35 of the embodiment of Figures 2 to 4, the user holds the dust collecting container 35 and presses it down in order that the lower portion of the container 35, which is removably mounted on the support part 50, compresses the compression coil spring 55b. This also disengages the engagement part 32 of the cyclone cover 31 from the container 35. The user can then remove the container 35 from the support part 50. After emptying the container 35, the user inserts the insertion pin 55a of the support part 50 into the recess 35a provided in the lower portion of the container 35, and then presses down on the dust collecting container 35 to compress the coil spring 55b and brings the upper portion of the dust collecting container 35 into alignment with the engagement part 32 of the cyclone cover 31. When the user releases the dust collecting container 35, the coil spring 55b expands, urging the container 35 into engagement with the engagement part 32 of the cyclone cover 31. Thus, the dust collecting container 35 is supported at one end by the engagement part 32 and at the other end by the support part 50.

In case of a screw-engagement structure, such as that illustrated in Figure 5, rotation of the dust collecting container 35' counterclockwise separates the dust collecting container 35' from the engagement part 32' of the cyclone cover 31'. When emptied, the dust collecting container 35' is re-engaged with the cyclone cover 31' by rotating the container 35' clockwise.

As explained above, the cyclone dust collecting device for a vacuum cleaner in accordance with the present invention improves the cleaning efficiency of the vacuum cleaner, even when the orientation of the cyclone dust collecting device changes during operation. Furthermore, the device provides a safer way of emptying the contents of the dust collecting container, by preventing the dispersal of contaminants from the grille and protecting the grille.

CLAIMS

1. A cyclone dust collecting device for a vacuum cleaner, comprising:

a cyclone body for connection to a telescopic extension pipe of the vacuum cleaner and arranged to generate a swirling vortex from an inflow of air and contaminants; and

a cyclone housing detachably engaged with the cyclone body, the cyclone housing having a slanted partition with a through-hole formed therein, the slanted partition dividing an interior of the cyclone housing into an upper space for separating the contaminants from the air by guiding the swirling vortex of air and a lower space for receiving the contaminants that have been separated from the air.

2. A cyclone dust collecting device according to claim 1, wherein the cyclone housing comprises;

a cyclone cover having a cylindrical shape, an open upper end, and a lower closed end, the open upper end being engaged with the cyclone body, the lower closed end being closed by the slanted partition; and

a dust collecting container detachably engaged with a lower portion of the cyclone cover, the dust collecting container having an open end that is slanted to correspond with the slanted partition of the cyclone cover.

3. A cyclone dust collecting device according to claim 2, wherein the dust collecting container comprises a closed end which is slanted to correspond to the slanted partition.

4. A cyclone dust collecting device according to any preceding claim, wherein the slanted partition includes a dome-shaped protrusion formed on a centre thereof.

5. A cyclone dust collecting device according to any preceding claim, further comprising supporting means for supporting the cyclone housing with respect to the telescopic extension pipe and preventing separation of the cyclone housing from the cyclone body.

6. A cyclone dust collecting device according to claim 5, wherein the supporting means comprises:

a fixture member mounted to the telescopic extension pipe;

an insertion member movably disposed on the fixture member, the insertion member being received in a recess formed in a lower end of the cyclone housing when the cyclone housing is coupled to the cyclone body; and

a resilient member for biasing the insertion member into engagement with the recess.

7. A cyclone dust collecting device according to claim 1, wherein the cyclone housing comprises:

a cyclone cover having a cylindrical shape, an open upper end, and a lower end, the open upper end being engaged with the cyclone body, the lower end being slanted with respect to the slanted partition at a predetermined angle; and

a dust collecting container having an open end engaged with a lower portion of the cyclone cover by a screw connection, the dust collecting container being arranged to receive the contaminants that have passed through the through-hole of the slanted partition.

8. A vacuum cleaner comprising a cleaner body, a telescopic extension pipe coupled to the cleaner body via a flexible hose, and a cyclone dust collecting device mounted to the telescopic extension pipe, wherein the cyclone dust collecting device includes:

a cyclone body mounted on the telescopic extension pipe, the cyclone body being arranged to generate a swirling vortex from an inflow of air and contaminants; and

a cyclone housing detachably engaged with the cyclone body, the cyclone housing having a slanted partition with a through-hole formed therein, the slanted partition dividing an interior of the cyclone housing into an upper space for separating the contaminants from the air by guiding the swirling vortex of air and a lower space for receiving the contaminants that have been separated from the air

9. A vacuum cleaner according to claim 8, wherein the cyclone housing comprises;

a cyclone cover having a cylindrical shape, an open upper end, and a lower closed end, the open upper end being engaged with the cyclone body, the lower closed end being closed by the slanted partition; and

a dust collecting container detachably engaged with a lower portion of the cyclone cover, the dust collecting container having an open end that is slanted to correspond with the slanted partition of the cyclone cover.

10. A vacuum cleaner according to claim 9, wherein the dust collecting container comprises a closed end which is slanted to correspond to the slanted partition.

11. A vacuum cleaner according to claims 8 to 10, wherein the slanted partition includes a dome-shaped protrusion formed on a centre thereof.

12. A vacuum cleaner according to any preceding claim, further comprising means for supporting the cyclone housing on the telescopic extension pipe and preventing separation of the cyclone housing from the cyclone body.

13. A vacuum cleaner as claimed in claim 12, wherein the supporting means comprise:

a fixture member mounted to the telescopic extension pipe;

an insertion member movably disposed on the fixture member, the insertion member being received in a recess formed in a lower end of the cyclone housing when the cyclone housing is coupled to the cyclone body; and

a resilient member for biasing the insertion member into engagement with the recess.

14. A vacuum cleaner according to claim 8, wherein the cyclone housing comprises:

a cyclone cover having a cylindrical shape, an open upper end, and a lower end, the open upper end being engaged with the cyclone body, the lower end being slanted with respect to the slanted partition at a predetermined angle; and

a dust collecting container having an open end engaged with a lower portion of the cyclone cover by a screw connection, the dust collecting container being arranged to receive the contaminants that have passed through the through-hole of the slanted partition.

15. A cyclone dust collecting device for a vacuum cleaner, the device being constructed and arranged substantially as herein described and shown in Figures 2 to 5 of the drawings.

16. A vacuum cleaner constructed and arranged substantially as herein described with reference to Figures 2 to 5 of the drawings.

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Application No: GB 0118386.2 **Examiner:** Nicholas Mole
Claims searched: 1-16 **Date of search:** 10 October 2001

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int Cl (Ed.7): A47L 9/16 BO4C (3/00, 5/00, 9/00)

Other: Online: WPI EPODOC JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, P	WO 01/07168 A	(GBD) see esp. figures 4 and 5 and page 16 lines 19-24 and page 22 lines 9-12	1, 8 at least
A, P	WO 00/74548 A	(LG ELECTRONICS)	
A, P	WO 00/74547 A	(LG ELECTRONICS)	
A	US 5350432	(LEE)	
A, P	WO 01/05291 A (SHARP) and WPI abstract no. 2001-112661		

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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